## Dialysis Access Steal Syndrome: DASS

## By the end of this reading – residents should be able to

1. **List 6 risk factors for DASS**
2. **Give one clinical condition to match on each one of the 3 of 4 determinants of DASS**
3. **Tabulate 4 stages of DASS**
4. **List 5 options on encountering DASS**
5. **List 3 useful strategies to prevent DASS**

## Introduction

Dialysis Access-Associated Steal Syndrome (DASS) has as incidence 6% patients with an arteriovenous (AV) access. DASS is more commonly seen with brachial artery-based AV access compared to the radial artery-based AV access. Most DASS will not require intervention.

**Risk factors for developing DASS**

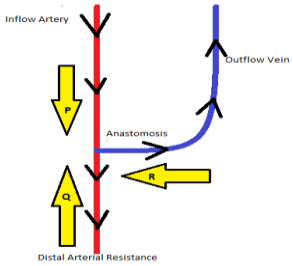
–AV access created from the brachial artery
–Diabetes Mellitus
–Female gender
–Coronary artery disease
–Peripheral vascular disease
–History of DASS with a prior AV access

## Pathophysiology

1. The estimated blood flow through the brachial artery is about 80 ml/min.
2. A functional AV access generally has a blood flow of ~600 to 800 ml/min implying that there is almost a tenfold increase in blood flow after the AV access creation.
3. To accommodate the high blood flow, there is dilation of the inflow artery and outflow vein mediated by release of nitric oxide.

**List 4 determinants of DASS**

1. Artery feeding the AV access: Arterial Inflow (p) above the anastomosis
2. Arterial supply distal to the arterial anastomosis of the AV access (q)
3. AV access: Outflow Resistance in the artery distal to anastomosis (r)
4. Collaterals




1. (P < Q), there will be retrograde flow from the distal artery into the AV access,especially during diastole, leading to distal tissue ischemia.(Stenosis in Subcalvian, Axillary, Brachial arterial systems.)

2. (Q >> P), such as seen in atheroslcerotic vascular disease affecting artery distal to anastomosis, there will be retrograde flow into the AV access during diastole. (native disease in radial and Ulnar system specially diabetic state, prior arterial cannulation etc)

3. (R < Q), this will mean a high outflow access. AV anastomosis had been made too large.

**3 scenarios where DASS can occur**

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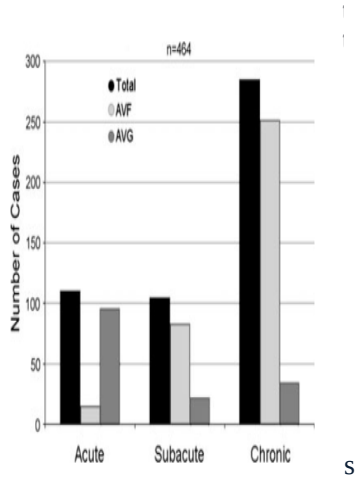
3. (R < Q),  this will mean a high outflow access. AV anastomosis had been made too large.

**RETROGRADE FLOW FROM DISTAL ARTERIAL SYSTEM TOWARDS THE AVF OUTFLOW MUST BE DOCUMENTED TO ESTABLISH DISGNOSIS OF DASS**

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AVG placements have an acute presentation with DASS whereas AVF creations will have a more subacute/chronic presentation

Clinical Symptoms of DASS

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|---|---|
| **Stage I** | Retrograde diastolic flow without any symptoms |
| **Stage II** | Pain during exercise and/or during dialysis |
| **Stage III** | Pain at rest |
| **Stage IV** | Tissue loss: Ulceration/necrosis/gangrene |

-Diminished or absent radial and ulnar pulses
-Relief of symptoms on compression of AV access
-Brachial artery digital index of 0.6 or less
-Digital pressures below 50 mmHG or non-recordable-Abnormal doppler waveform

**Some other signs and symptoms associated with DASS are:**

Acute presentations are coolness, pallor, pain, tingling, and numbness in the distal extremity.Chronic presentations will be include nail changes, ulcer, gangrene, muscle/tissue atrophy (signs of chronic malperfusion of an extremity

IMN is a variant of DASS caused due to an ischemic nerve damage leading to severe sensorimotor dysfunction of the ulnar, median and radial nerves without evidence of peripheral soft tissue damage. The onset of IMN is immediate after AV access creation, and is associated with excruciating hand pain. Early recognition of IMN is crucial as it requires AV access ligation

## Testing and Diagnosis

If the clinical symptoms and physical examination are suggestive of DASS, then the AV access flow and digital BP are measured using Doppler ultrasonography with and without AV access compression. Relief of symptoms on compression of the AV access is highly suggestive of DASS, as occlusion of flow in the AV access improves distal perfusion.

## Treatment of DASS

Medical intervention is dependent on the stage of DASS

Stage 1: Observe

Stage 2: If severe Intervene.

Stage 3 and 4: Intervene

**Patients deemed candidates for surgical intervention must undergo angiography to assess for presence of arterial stenosis proximal as well as distal to the AV access. Angioplasty of arterial stenosis can restore arterial perfusion and potentially relieve DASS symptoms**

1. **Arterial inflow**

Angiographic imaging must include the entire arterial tree that supplies blood to AV access, including subclavian artery from its origin at the aorta, the inflow artery, the AV anastomotic site. Any stenotic lesions can be intervened on with the help of balloon angioplasty.

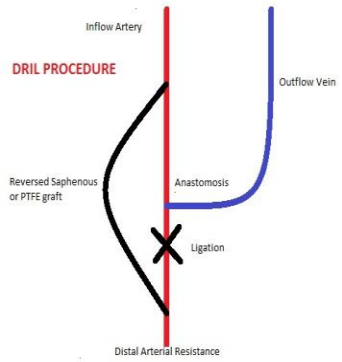
2. **Distal arterial flow**

One should make sure that distal artery is assessed for presence for stenosis. Restoration of distal arterial flow with AV access compression supports the diagnosis of DASS

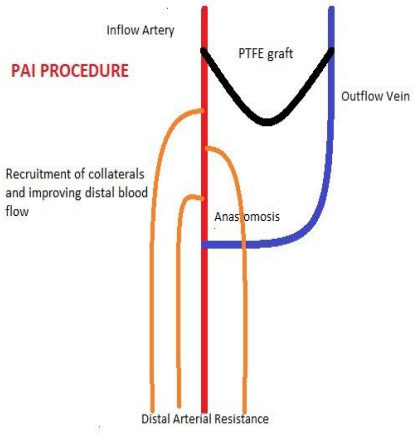
If restoration of arterial inflow and distal artery arterial perfusion does not relieve the symptoms of DASS then one has to choose a surgical option that is best suited for the patient

The surgical options include:

1. DRIL (Distal Revascularization – Interval Ligation)
2. PAI (Proximalization of Arterial Inflow)
3. RUDI (Revision using Distal Inflow)
4. Ligation of the AV access
5. Banding of the inflow




DRIL consists of a low resistance collateral conduit (either reversed saphenous vein graft or PTFE graft) anastomosed from proximal inflow artery to distal outflow artery resulting in greater perfusion to hands/fingers. To prevent retrograde flow in diastole the artery below the AV access is ligated (abolishes the 'suction effect' of blood through the AV access from distal artery). Blood is still able to flow from the inflow to the outflow vein as it is a low resistance pathway.




The PAI procedure involves using a PTFE graft to create a more proximal AV anastomosis resulting in recruitment of more collaterals which could not be recruited earlier due to the more distal nature of the AV anastomosis. This enhances perfusion to hands/fingers and also removes the need to ligate the artery below the original AV access, making it a less invasive process

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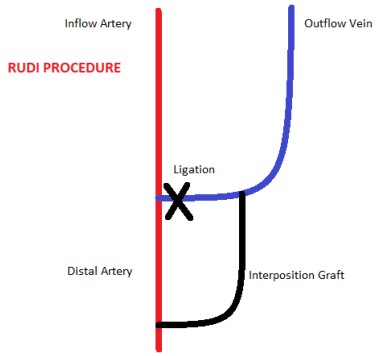


RUDI procedure is particularly useful in steal syndrome related to high flow brachial AV access. This reduces access flow rate by as much as 50% (Minion et. al). This procedure is an alternative to banding but should be used only if distal artery used for 'new' inflow is patent, otherwise there is a high risk of persistent steal. An advantage of this procedure is it lengthens the needling area for dialysis access

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**Banding**

This aims at reducing access flow, thus can be performed only in patients with high flow related DASS. It can be done with non absorbable sutures, small interposition graft, or by narrowing the vessel with a tight Dacron or PTFE cuff. Banding a low flow access can resolve steal but will lead to inadequate dialysis and raise potential for access thrombosis. When banding is done under intraoperative flow measurements with goal of ~400ml/min in native fistula and ~600ml/min in grafts, post-operative access patency and dialysis adequacy are better.

**Ligation**

Ligation resolves steal syndrome immediately. However it will lead to loss of dialysis access and cause the need for alternative access creation which again will be at risk of steal syndrome. Ligation is indicated if there is acute limb ischemia or IMN as described above. Reactivation of the access may be attempted but there is a high risk of thrombosis once ligated. A proposed algorithm in literature is to ligate the access, diagnose the etiology, perform DRIL, RUDI or PAI then reactivate the fistula.

## Conclusion:

1. Prevention is the key
2. Vessel mapping is done prior to the creation of the AV access.
3. Careful physical examination and duplex imaging should be done to assess for arterial insufficiency.
4. If arterial stenosis is identified then angioplasty must be done prior to AV access creation.
5. In high risk patients, the following must be considered:

**Useful Strategy:**

- Avoid distal brachial artery inflow
- Limit the size of the arterial anastomosis to 4 mm
- Consider pre-emptive RUDI / PAI if indicated by the imaging.

**Acknowledgment:** This heavily relied on the summary of Steal Syndrome Dr Bhavnish Bucktowarsing MD